

# Traffic Signal Optimisation and Virtual Infrastructure

What INRIX's recent success with SBRI means for current and future transport agency operations

For over 30 years, the Small Business Research Initiative (SBRI) has helped drive innovation for public benefit. A recent SBRI-backed competition asked the private sector to produce solutions that would help the UK lead a clean, growth-led recovery from the coronavirus pandemic and improve strides toward the eventual goal of net zero carbon emissions.

This SBRI challenge is managed by the Department for Transport (DfT) and it is part of a multi-pronged effort to deliver on state goals for reduced traffic congestion and greenhouse gas emission. This competition was a response to a recent challenge set by the DfT: how can we better utilise data analysis to support local areas in making real-time traffic interventions and improve network optimisation?

The success of INRIX's submission can not only be measured in its execution against programme objectives, but in also providing a logical pathway forward from deeply entrenched transport management paradigms.

## Key Takeaways from SBRI

The SBRI submission from INRIX was a platform of tools developed in collaboration with 12 different local authorities under the project name Performance Analysis Trajectory Help (PATH). Using GPS floating vehicle data, PATH delivered a virtual infrastructure of city road corridors and junctions, giving agencies high-level awareness of traffic signal performance across the entire transportation network.

The tools empower local authorities to assess signal performance broadly along road corridors or zoom in on a particular junction of their choosing. Vehicle trip delay data is visualised through time-space diagrams (Figure 1.), offering fast and actionable insights into signal performance and congestion. This enables the identification and prioritisation of maintenance projects where work can be the most impactful, and the tools allow the public sector to follow up with before-and-after comparisons when work is completed.

The PATH project provided public sector clients with the tools (and data) to assess their key routes and roads on their performance and the ability to optimize traffic signals. The metrics within PATH helped identify the most impactful traffic signals junctions that cause a delay to the travelling public.

*A summary of SBRI projects has been published on the Transport Technology Forum (TTF) website. To learn more about the projects of the SBRI Congestion Challenge, visit <https://ttf.uk.net/resources/sbri-congestion-challenge-project-reports/>*

# YOR001

## A59 Eastbound (Poppleton Bar to The Fox)

2018: Mon 16 Apr 2018 Tue 17 Apr 2018  
2021: Mon 16 Apr 2021 Tue 17 Apr 2021

### Slowest Journeys in week commencing Mon 16 Apr 2018

Only journeys that complete the entire route are shown

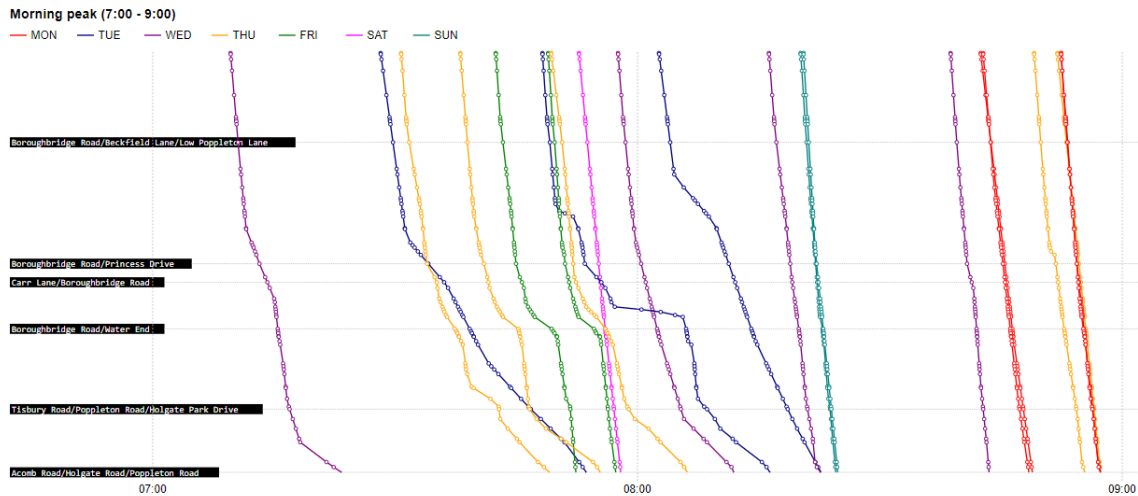


Figure 1. Time-space diagrams indicate vehicle trip delays, giving insight into signal performance

### Why Virtual Infrastructure Matters

PATH verified the potential value of stepping away from traditional methods of determining performance and into data-driven software platforms for traffic signal optimisation. Traditional methods call for physical hardware to measure traffic congestion, but such solutions are costly in that they must be monitored, maintained, and replaced on an ongoing basis.

Getting meaningful insights from hardware has been a challenge as well. Data collected at the ground level by sensor detection require a sizeable effort to extract and analyse, and even still, only offer a limited understanding of how individual signals impact peripheral junctions. This makes it difficult for traffic operations managers to prioritise signal retiming projects where they are needed most. Consider also the time and budget local authorities burn through each year pulling data from urban traffic control systems, either from following a pre-determined maintenance schedule or in response to a suspected issue, only to find that the signal in question was performing optimally all along. What if they didn't need to?

Traffic signal optimisation is the first step in reducing traffic congestion, lengthy trip delays, and carbon emissions. Ensuring local authorities can pinpoint the most significant issues and direct their resources appropriately will produce the best results. Cloud-based solutions powered by GPS floating vehicle data make this possible.

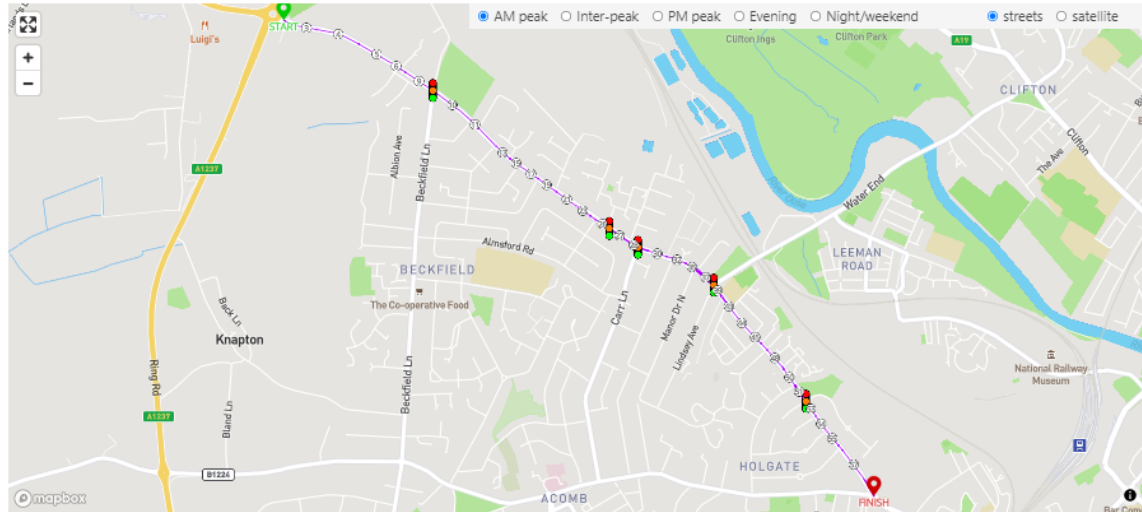
# YOR001

## A59 Eastbound (Poppleton Bar to The Fox)

### Heatmap

Week number

2018: 15 Nov 10 Apr 2018 15 Nov 10 Apr 2018  
 2021: 15 Nov 10 Apr 2021 15 Nov 10 Apr 2021



Seq	SegmentID	Length(m)	Baseline speed(kph)	Junction	Worst 10% PI (90th percentile)					Median Index PI					Sample size			
					AM	Inter	PM	Eve	Ni/WE	AM	Inter	PM	Eve	Ni/WE	AM	Inter	PM	Eve
0	4322267_0	6.787	50		162	170	172	127	152	120	120	121	105	113	64	237		131
1	4322267_1	9.232	50		162	154	196	123	149	117	117	122	105	112	64	237		132
2	4322267_2	37.119	50		144	146	172	114	132	115	113	117	104	110	63	238		131
3	4322267_3	84.233	50		145	145	172	106	128	110	108	116	96	104	64	240		131
4	4322267_4	178.839	50		145	143	168	103	124	103	105	115	94	98	64	240		132
5	4322267_5	161.913	50		145	143	172	105	132	103	105	116	93	100	64	239		130
6	131931842_0	19.409	50		154	145	172	107	133	112	109	116	97	104	64	239		129
7	131931842_1	12.871	50		154	152	172	107	133	114	109	115	97	104	64	238		129
8	131931842_2	20.084	50		175	152	172	111	143	115	110	116	98	104	64	237		129
9	4322269_0	132.373	50		375	341	281	136	303	145	130	137	104	122	65	237		130
10	131832074_0	195.159	50		218	187	212	118	163	133	120	135	106	118	56	196		126
11	131832074_1	41.058	40		209	176	200	118	149	120	119	130	110	110	55	200		125
12	131832074_2	95.838	50		209	170	200	128	149	120	118	130	111	111	56	202		125

Figure 2. Heat maps give local authorities high-level awareness of where congestion is the worst and during which part of the day

### Community Feedback

Collaboration played an essential role to the success of PATH, as it was feedback from local authorities that helped to create the best possible solution. For many, the high-level awareness of road network performance that virtual infrastructure provides was very well received. "It is important for us to see the impact on adjoining side roads," said Daniel Anderton, transport control centre manager of Hertfordshire County Council. "We would use the metrics to help review our junction delays, [which is] great for supporting the adjustment of signal timings."

The challenge for traffic management authorities isn't only to ensure optimal signal performance; they must provide demonstrable evidence to accurately model future funding requirements or elevate awareness of major issues. "We can evidence the junctions that are problematic and the time of day we are seeing delay," said Jackie Davies of Bristol Traffic Control. "Using the platform, we can prioritise our

validation and maintenance programmes, [and] it will help us to push for additional budget to support junction improvements."

The DfT acknowledges the importance of embracing data-driven solutions to achieve its goals. "The PATH project has brought a crucial step-change towards a clearer and deeper understanding of traffic signal performance," Darren Capes, ITS Policy Lead at the DfT stated. "We must continue to make the best use of data and particularly information that is typically inaccessible or too complex to understand in an operational environment. PATH begins to provide us with the tools we need to improve congestion and travel delay, ultimately contributing towards reduced carbon emissions and better journey reliability."

INRIX IQ Signal Analytics, a fully baked application based on the same principle of utilising floating vehicle data to optimise signal performance, is live for American markets and has already been used by several public transportation agencies to great effect. We plan to unify the learnings of PATH with this existing application to deliver a comprehensive solution to the UK in the near future.

Through the exploration of this development project, GPS floating vehicle data has proven to be a viable (even superior) alternative to legacy traffic signal performance measurement methods. With the growing urgency to reduce traffic congestion and manage carbon emissions, Highway Authorities face pressure to demonstrate progress toward policy goals. Those that are ready to embrace data-driven solutions will quickly realise improved success metrics, budget savings, and reduced greenhouse gas emissions.

*To find out more about how INRIX is shaping the future of traffic signal management in the UK, click [here](#).*